6.0. FLIGHT PLANNING

As has been mentioned, many of the tests can be conducted concurrently, or at least on the same intercept, ingress or attack. In addition, some of the tests will be more important than others. Past performance of the system, the specific system design, and ground test results will point out the areas that require emphasis. Finally, climbs/descents, accelerations/decelerations and positioning of targets and test airplanes requires fuel and time and must be kept to a minimum. Preflight planning is needed to insure that all the data that can be taken on each run are planned for while at the same time not overloading the evaluator. Priorities must be set for each data point so that if fuel/time run short, the most important data points have been identified and can be obtained first. A well thought out plan for the conduct of the flight will maximize the data obtained over a given flight and insure that the critical items are obtained first.

The first step in planning is to group the data points that are compatible on concurrent runs. This must be done in light of the type of run being performed, the characteristics of the specific systems under test, and airspace constraints of the test. As an example, for an air-to-air run against two targets, a search mode maximum range data point could be taken concurrent with a maximum acquisition range data point. Then, as the targets continue inbound they can maneuver for a range resolution data point, while the evaluator checks for ambiguous ranges and blind ranges.

Airspeeds and altitudes should be chosen that maximize fuel conservation without destroying the mission relation of the test. Where speed and altitude are not critical to making the test mission relatable, medium to high altitudes near the maximum endurance airspeed should be chosen. As an example, the maximum range measurements can be made at a maximum endurance airspeed since the speed used will not affect the data. Tests that require the target within 10 to 15 nm can be performed outbound to the test area or following a converted intercept. Tests should also be grouped by altitude. Usually low (below 5,000 feet AGL), medium (10,000 to 20,000 feet MSL) and high altitude (above 20,000 feet MSL) tests should be grouped together during the flight.

Navigation test flyover data points pose a particularly challenging flight planning exercise. Since the flyover method requires that the tests be performed at a very low altitude, extensive planning is warranted to group them together to preclude numerous climbs and descents. Usually it proves efficient to merely stay low for the duration of the navigation tests and to work as many other low altitude data points in as possible between flyover opportunities. Air-to-ground radar and FLIR data points are often compatible with a series of flyover data points.

After the runs have been designed, an estimate should be made of the time necessary for set up and to perform the tests. Armed with the time required for each run, a timetable of the flight can be drawn up and the maximum number of tests scheduled within the flight time and fuel constraints. The data cards should be laid out in order, numbered, and the expected time into the flight at the beginning of each test placed on the card. This allows the evaluator to have a running estimate of how effectively he or she is managing the flight time available as the flight progresses. The evaluator should also mark the low and high priority tests through some ranking scheme. The sample data cards are provided with a priority Low/Medium/High (L/M/H) selection. As time becomes a problem, as indicated by the elapsed time since launch and the time estimate on the data card, the low priority tests should be skipped in preference to the high priority tests.

There is no single way to structure the tests that will work for every situation. Common sense and an understanding of the requirements of each test will define most of the flight. Unfortunately, this portion of the test is often given a minimum of thought in deference to "figuring it out in the air." This mindset must be avoided and the flight must be laid out beforehand. A successful test will almost always result. Success is best insured by knowing the system, planning the flight and flying the plan.

Safety must also be an important criteria in preflight planning. Airspeeds, altitudes and rates of descent/climb should be chosen not only for their utility in gathering data but also for their effects upon safety. In aircraft where gross weight restricts maneuvering, tests should be laid out such that high g data points are performed after fuel is expended and the gross weight is within the required limits. The work load should be budgeted so that the evaluator has enough time available to properly perform the test and still aviate, navigate, look for traffic, etc. Ideally, the test should be performed in a dual piloted aircraft, allowing one pilot to concentrate on the test while the other flies the aircraft. With two pilots, proper crew coordination is an important safety concern.

Where airborne targets are used, a face to face brief prior to the test must be required. The procedures for each test should be understood by all participants. A procedure to immediately terminate each test whenever any participant notices any unsafe condition must be thoroughly briefed.

The test systems and safety of flight systems required for each test and target aircraft must be outlined and used as a criteria for test cancellation. It is much cheaper to cancel a test while on the ground than in the air.

Time should be set aside during the planning stage of any test for all the participants to gather and discuss the safety of flight issues. A simple but effective procedure is to reserve a short period of time (perhaps a half hour) during the planning process for all participants to discuss possible safety issues, system failure modes or accidents that could occur and to plan how to react in their eventuality. A half hour of planning is a small price to pay for a safe test evolution.

7.0. CASE STUDY

7.1. INTRODUCTION

The previous sections provided a discussion of how to perform basic flight tests on air-to-ground radar, air-to-air radar, navigation, electro-optical and stores management set systems. A basic assumption for the development of these techniques was that a minimum of instrumentation was available outside of the production aircraft's complement of systems. In implementation this is often the case. Scheduling or cost may limit the amount of instrumentation and support available to perform a test. Additionally, as explained in Chapter 1, even when instrumentation allows extensive data collection, the test techniques are often similar or even identical and the rough, hand-held data is still collected. The data is then available for immediate use, without the requirement for extensive data reduction and formatting usually needed after automatic collection. This immediate feedback is used for adjusting of the next test evolution or as a means for focusing the data reduction effort on test events which are critical.

The following case study is presented to illustrate the implementation of the thought process used in developing the test procedures outlined in the previous sections. This case study is a straight-forward application of a couple of the test procedures outlined above without the addition of extensive instrumentation requirements. The scenario is contrived but illustrates how the techniques above can be used to provide quick and supportable answers to real world questions where extensive preparations and instrumentation are not possible.

7.2. AIR-TO-GROUND RADAR RESOLUTION USING A MINIMUM OF INSTRUMENTATION

7.2.1. Background

This case study is intended to illustrate how the techniques outlined in the previous sections may be applied to quickly answer a question about the technical performance of a radar. The scenario is based upon a fictional United States Navy F/A-XX aircraft with the APG-XX radar. The APG-XX radar has been developed as an avionics upgrade to the F/A-XX aircraft. The Navy program manager, responsible for the development and procurement of the upgrade, (PMA-XXX) has heard via his program contacts that the APG-XX radar is "not even close" to meeting the air-to-ground resolution specification. A specification is a design requirement imposed upon the contractor as a means of defining the minimum acceptable standards for the system under development. PMA-XXX called your department head and ordered a "quick test" to determine the air-to-ground range and azimuth resolution of the radar. You have been assigned as the project engineer.

The contractor has been prompted by PMA-XXX to make the back seat of the single prototype of this two seat strike